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AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 193

THE AVRO "COMMODORE" TOURING AIRPLANE (BRITISH)

A Cabin Biplane

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A Cabin Biplane

The Avro "Commodore" is a heavily staggered cabin biplane of metal construction, designed for comfort and robustness rather than for high performance. Realizing that in a single-engine airplane likely to be used for extensive tours at home and abroad, engine reliability would be of vital importance, the power plant chosen for the "Commodore" was the Siddeley Lynx of 215 brake horsepower. Using the very pronounced wing stagger familiar from other Avro types, the view from the cabin has been made exceptionally good, notwithstanding the large N.A.C.A. cowling ring which surrounds the radial engine. (See figs. 1,2,3,4.)

Structurally the Avro "Commodore" follows standard Avro practice, the fuselage having a primary structure composed of welded-steel tubes, and the wings having spars formed from corrugated strips, carrying metal ribs (fig. 5).

The covering of fuselage and wings is doped fabric, and in the case of the fuselage the fabric is supported on longitudinal stringers of wood carried on light wooden formers.

A somewhat unusual bracing arrangement has been adopted for the wings. These are of biplane form and very heavily staggered, so that the rear spar of the top wing is vertically above the front spar of the lower wing. A single N strut is fitted in the gap on each side, and the lift and anti-lift wing bracing is in a single plane. In order to reduce maintenance rigging to a minimum the anti-lift member is a streamline steel strut of large dimensions, through the center of which passes the lift wire. At first sight this very simple arrangement appears incomplete, but actually the wing structure is completely stabilized by the attachments to the fuselage at the inner end, and by the N struts at the outer end of the bracing. With biplane wings so heavily staggered, it is virtually impossible to arrange for wing folding, and in the Avro "Commodore" no wing-folding arrangement is provided.

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*From Flight, May 31, 1934.

SEMICANTILEVER LANDING GEAR

The landing gear is of the split type in which the wheels are carried on short stubs on large-diameter telescopic tubes. The telescopic tube and sloping bracing strut are streamlined into a common fairing, and spats are fitted over the wheels. The lateral bracing of the landing gear is very simple and consists for each leg of a single streamline steel strut running to the center of the bottom of the fuselage. At its outer end this strut attaches to the outer member of the telescopic leg, so that there is no lateral displacement of this when the wheel moves up and down. The price paid for this absence of lateral movement is the slight overhang, say, 6 or 8 inches, of the lower portion of the telescopic tube, but as this tube is of large diameter, it is well capable of resisting the cantilever loads. The Dunlop wheels are fitted with independently operated brakes, and in place of the old-fashioned tail skid there is a castering tail wheel.

The Siddeley Lynx engine is completely surrounded by an N.A.C.A. cowling ring, and a single exhaust collector pipe runs under the fuselage to a point near the trailing edge of the lower wing. Gasoline is carried in two tanks in the upper wing, one on each side of the fuselage, and each tank has a capacity of approximately 25 gallons. The position of the tanks is, of course, such that direct gravity feed to the engine is available. A Fairey metal propeller is fitted.

The internal lay-out of the cabin has been very carefully studied, and the seating arrangement consists of two separate seats side-by-side in front, from either of which the airplane can be piloted. Behind these two seats is a sofa seat running right across the cabin and wide enough in a pinch to seat three passengers. Underneath the sofa seat is a large luggage compartment.

CONTROLS

Controls of normal type are provided, the wheel control for the elevator and ailerons being of the "swing-over" type, so that the airplane can be piloted from either the left or the right seat. There is a locking catch which en-

gages when the wheel is fully over to one side or the other, and another catch locks the control column in a fore-and-aft position to prevent the elevator flapping about when the airplane is standing on the ground.

Instrument-board arrangement has been given very particular attention, and in the Avro "Commodore" the instruments are not only farther away from the pilot than is usually the case, which should cause a great deal less fatigue in watching the instruments, but they are placed on a sloping panel, which also assists in making them very easily readable. The equipment of the cabin is extremely complete. The sketch (fig. 6) shows the cabin arrangement. The electrical equipment includes a starter, so that the engine can be started by the pilot himself from the cabin.

Large windows in the side of the fuselage and a windshield composed of very large triangles afford an excellent view in all essential directions. The top wing does not extend across the cabin, and thus it has been possible to provide a large roof light. Behind this is a circular emergency exit at present covered with fabric. If a transparent covering were substituted over this exit, it would be a considerable advantage since in that case the occupants of the airplane would be able to have a good look upward and backward before taking off, so as to insure that another airplane was not about to land at the same time. The cabin is well ventilated and the noise from the engine is not obtrusive, so that it is fairly easy to carry on a conversation during flight.

The airplane is equipped with navigation lights for night flying and also carries blind-flying equipment, so that for extended tours, when all sorts of weather may be encountered, the owner of an Avro "Commodore" should be able to continue his flight to his destination.

A gasoline capacity is provided sufficient for $4\frac{1}{2}$ hours at a cruising speed of 110 miles per hour, or a range of approximately 500 miles in still air. With this quantity of gasoline and four people on board, there is still available a load of 209 pounds for luggage, etc. If a fifth person is carried the luggage load is reduced to about 50 pounds for full range. The gross weight of the airplane is 3,500 pounds, and as the tare weight is 2,225 pounds, the ratio of gross weight to tare weight is 1.575. In other words, the airplane carries 57.5 percent of its own weight as disposal load. This is about an average

ratio and is actually very much better than appears, because in the tare weight is included the very complete cabin equipment.

CHARACTERISTICS

Dimensions:

Length, over-all	8.33	m	27	ft.	3	in.
Height, over-all	3.05	"	10	"	0	"
Wing span (both)	11.40	"	37	"	4	"
Wing chord (both)	1.45	"	4	"	9	"
Gap	1.60	"	5	"	3	"

Dihedral angle 2.5°
Angle of incidence 3.25°

Areas:

Wings, including ailerons	28.5	m^2	307	sq.ft.
Ailerons (total)	2.92	"	31.5	"
Stabilizer and elevator	3.67	"	39.6	"
Rudder	1.11	"	12.0	"
Fin	.31	"	3.3	"

Weights:

Tare weight, including cabin furnishing	1009	kg	2225	lb.
Pilot	72.5	"	160	"
Passengers (3, at 160 lb.)	217.7	"	480	"
Baggage	94.8	"	209	"
Fuel (223 liters = 49 gal.)	170.9	"	377	"
Oil (23 liters = 5 gal.)	22.2	"	49	"
Total disposable load	578	"	1275	"
Gross weight	1587	"	3500	"

Loadings:

Wing loading	5.28 kg/m^2	10.82 lb./sq.ft.
Power loading	7.02 kg/hp	15.45 lb./hp.

Performance:

Maximum speed at sea level	209 km/h	130 mi./hr.
" " " 1524 m (5000 ft.)	200 "	124 "
" " " 3048 m (10000 ft.)	185 "	115 "
Cruising speed at 305 m (1000 ft.)	177 "	110 "
Landing speed	80 "	50 "
Initial rate of climb	3.57 m/s	700 ft./min.
Time to 305 m (1000 ft.)	1.60 minutes	
" " 1524 " (5000 ")	9.50 "	
" " 3048 " (10000 ")	28.00 "	
Service ceiling	3505 m	11500 ft.

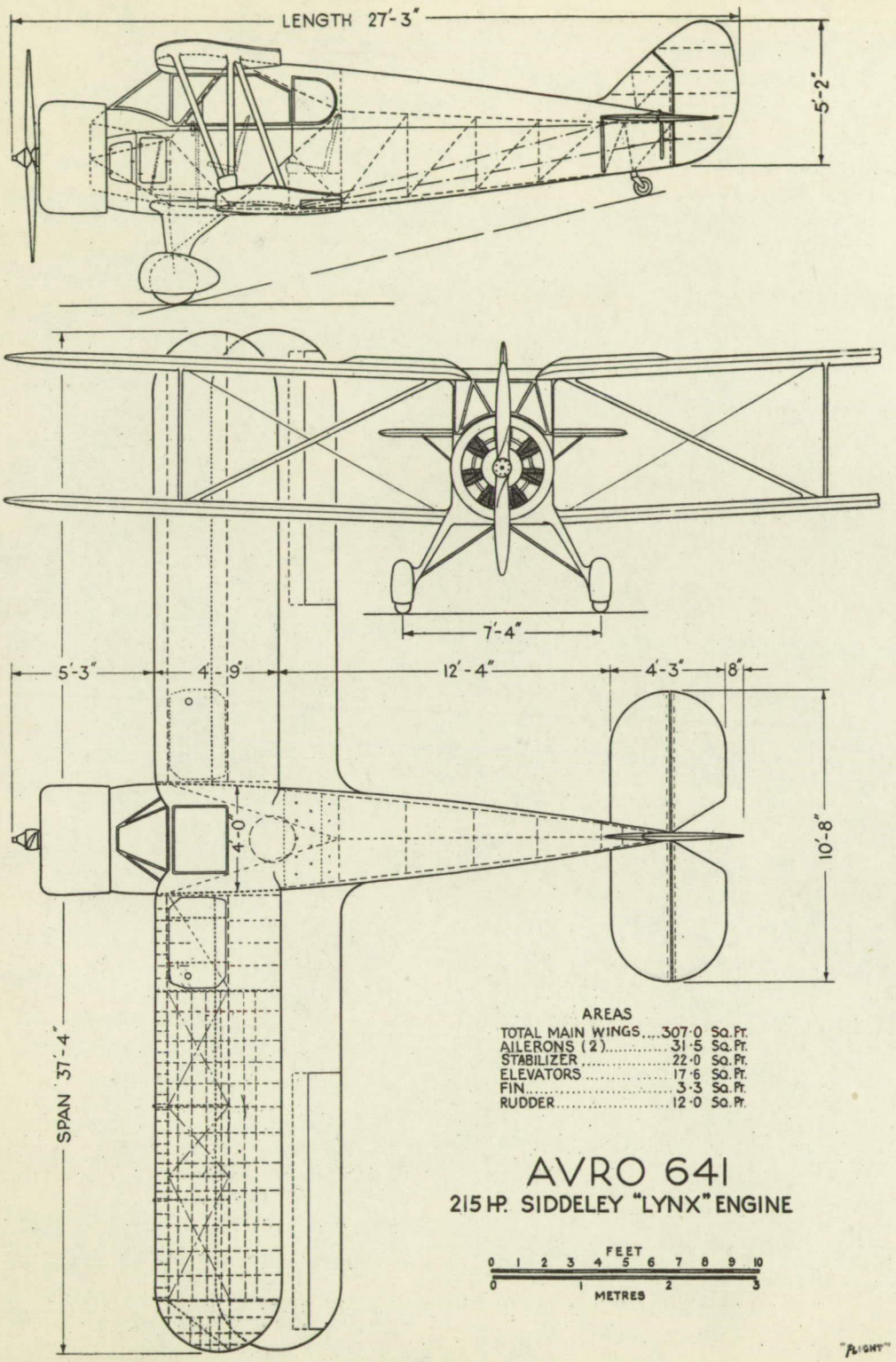

Figure 1.-General arrangement drawings of the Avro "Commodore" airplane.

Figure 2.-Three-quarter rear view of the Commodore airplane.

Figure 3.-Three-quarter front view of the Avro Commodore airplane.

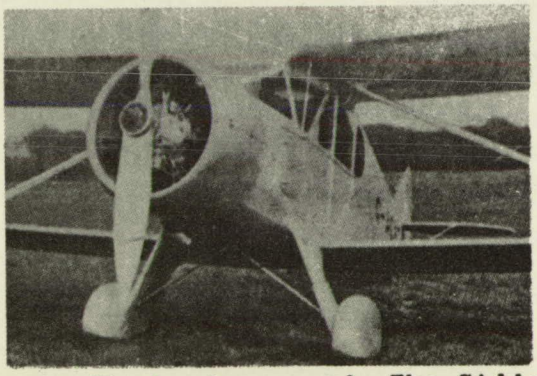

Figure 4.-The business end. The Siddeley "Lynx" is enclosed in a N.A.C.A. cowling. An electric starter is fitted.

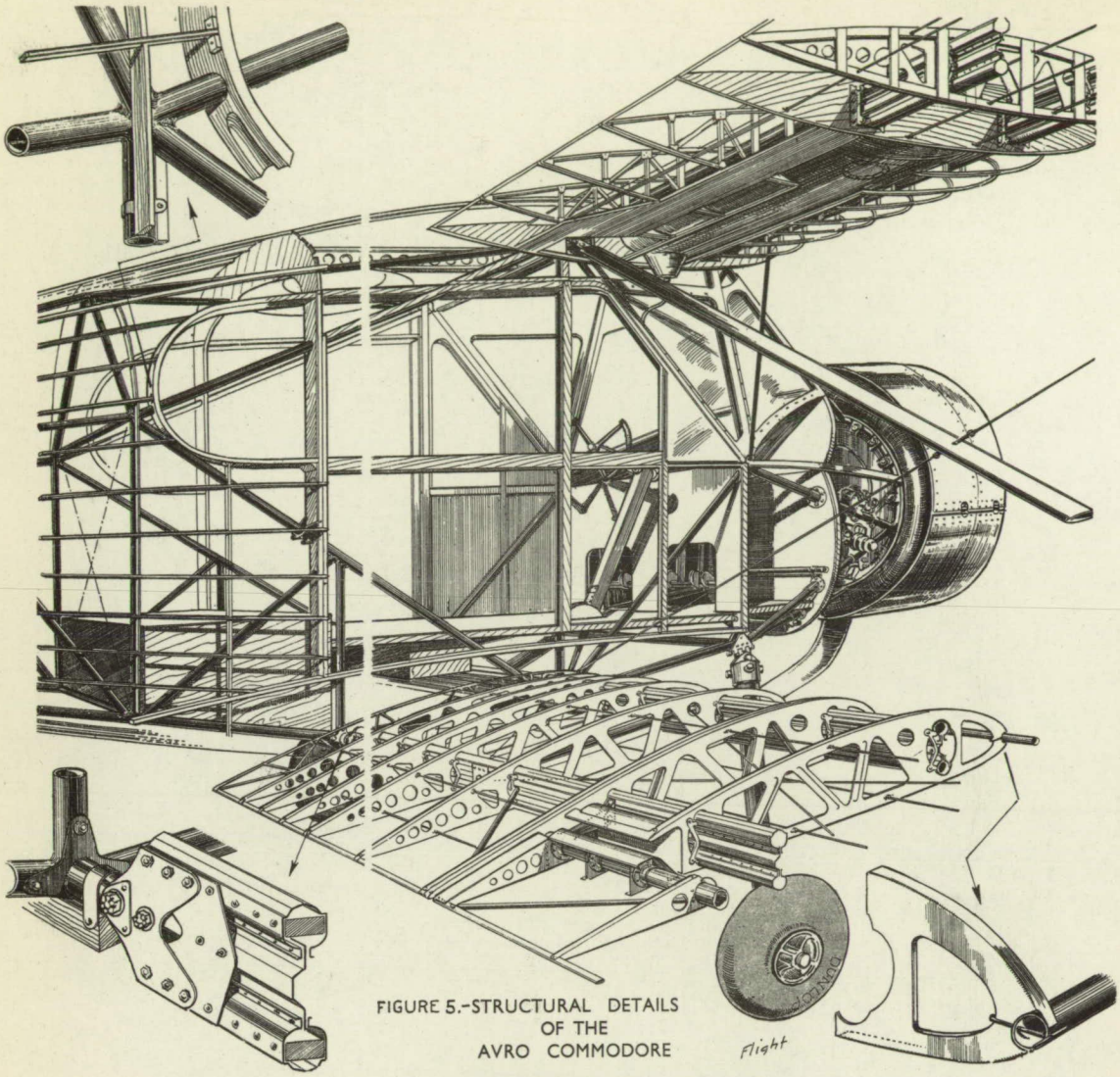

FIGURE 5.-STRUCTURAL DETAILS OF THE AVRO COMMODORE

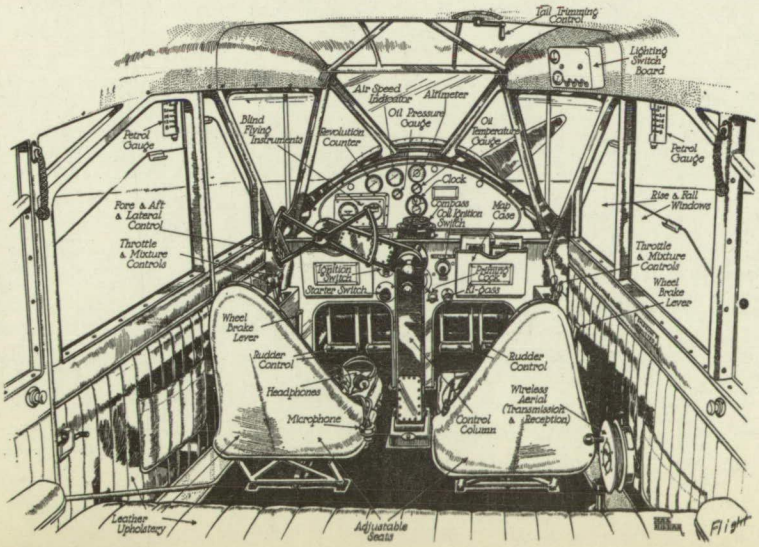

Figure 6.- The cabin arrangement of the Avro Commodore: Plenty of room everywhere, and a good view in all essential directions are the outstanding features. The instrument board lay-out is unusual.